

PATENT APPLICATION  
of  
MILAN C. MARAVICH  
JEFFREY A. MANN  
and  
DAVID J. JOCHEM  
for  
DRINK CUP AND LID  
Client Reference BP-208  
Attorney Docket 5723-73575

## DRINK CUP AND LID

## BACKGROUND

The present disclosure relates to drink cups, and particularly to lids for drink cups. More particularly, the present disclosure relates to a seal established  
5 between a drink cup and a lid mounted on the drink cup.

## SUMMARY

According to the present disclosure, a liquid container comprises a cup including a brim, a floor, and a side wall extending from the brim toward the floor.  
10 The side wall includes a radially inwardly facing first annular seal surface. The brim includes a radially inwardly facing second annular seal surface, an axially upwardly facing third annular seal surface, and a radially outwardly facing fourth annular seal surface.

The liquid container also comprises a lid including a closure and a  
15 closure mount ring appended to the closure. The closure mount ring is coupled to the brim to retain the closure in a position closing a mouth opening into a liquid reservoir chamber formed in the cup.

In illustrative embodiments, the closure mount ring includes four seal rings. A first seal ring is arranged to engage the radially inwardly facing first annular seal surface on the cup to establish a first liquid flow barrier therebetween. A second  
20 seal ring is arranged to engage the radially inwardly facing second annular seal surface on the cup to establish a second liquid flow barrier therebetween. A third seal ring is arranged to engage the axially upwardly facing third annular seal surface on the cup to establish a third liquid flow barrier therebetween and a fourth seal ring is  
25 arranged to engage the radially outwardly facing fourth annular seal surface on the cup to establish a fourth liquid flow barrier therebetween.

In illustrative embodiments, two annular retainers are included in the lid to engage annular inner and outer portions of the cup to help retain the lid in a mounted position on the cup closing an opening into a liquid reservoir chamber  
30 formed in the cup. A first lid-removal blocker wall is included in the lid and arranged to engage an annular undercut formed in the cup during movement of the lid in an

outer direction away from the floor of the cup to provide a first of the annular retainers and block unwanted removal of the lid from the cup. A second lid-removal blocker wall is included in a peripheral portion of the lid and is arranged to engage a terminal end of the brim of the cup during movement of the lid in the outer direction to provide a second of the annular retainers and assist in blocking unwanted removal of the lid from the cup.

Additional features of the present disclosure will become apparent to those skilled in the art upon consideration of the following detailed description of illustrative embodiments exemplifying the best mode of carrying out the disclosure as presently perceived.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The detailed description particularly refers to the accompanying figures in which:

Fig. 1 is a perspective view of a lid and cup in accordance with the present disclosure before the lid is mounted on the cup;

Fig. 2 is a top plan view of the lid of Fig. 1 showing a closure including a round hub providing a straw receiver, five radially extending spoke ribs terminating at the hub, and an inclined plate located between each pair of adjacent spoke ribs and showing a closure mount ring encircling the spoke ribs and inclined plates;

Fig. 3 is a sectional view of the lid taken along line 3-3 of Fig. 2 showing configuration of a downwardly opening annular brim receiver defined by the closure mount ring and sized to receive an annular brim of the cup therein as suggested in Figs. 5 and 6;

Fig. 4 is a transverse sectional view taken along line 4-4 of Fig. 2 showing one of the spoke ribs (in solid) when the lid is mounted on the cup as shown in Fig. 6 and showing deformation of that spoke rib (in phantom) of the type that would occur during mounting of the lid on the brim of the cup;

Fig. 5 is an enlarged sectional view of portions of the lid and cup of Fig. 1 before the lid is mounted on the cup;

Fig. 6 is a view similar to Fig. 5 after the lid is mounted on the cup showing formation of a series of liquid flow barriers to retain liquid in a reservoir chamber formed in the cup owing to sealing engagement between the closure mount ring of the lid and both of a side wall and the brim of the cup and showing retention of the lid on the cup owing, in part, to engagement of a portion of the lid in an “undercut” formed on an interior surface of the cup at a junction between the side wall and the brim of the cup;

Fig. 7 is a top plan view of a lid in accordance with a second embodiment of the present disclosure;

Fig. 8 is a sectional view taken along line 8-8 of Fig. 7;

Fig. 9 is an enlarged view of a portion of the lid cross-section of Fig. 8;

Fig. 10 is a perspective view of the lid of Fig. 7;

Fig. 11 is a sectional view (similar to Fig. 8) showing a stack comprising two of the lids shown in Figs. 7 and 10; and

Fig. 12 is a partial sectional view showing a lid of the type shown in Figs. 7-11 mounted on a first cup that is nested in an underlying second cup.

#### DETAILED DESCRIPTION

A liquid container 10 includes a cup 12 and a lid 14 as shown in Fig. 1. Lid 14 includes a closure 16 and a closure mount 18 configured to be mounted on a brim 20 of cup 12 to arrange closure 16 to close an opening into a liquid reservoir chamber 22 formed in cup 12 as suggested in Fig. 6. Another lid 114 in accordance with the present disclosure is shown in Figs. 7-12.

In illustrative embodiments, retainers 24, 26 included in lid 14 are arranged to engage portions of cup 12 to block unwanted removal of lid 14 from cup 12 as suggested in Figs. 5 and 6. Also in illustrative embodiments, four seal rings 31, 32, 33, and 34 are provided on lid 14 to engage companion annular seal surfaces 41, 42, 43, and 44 on cup 12 to establish four liquid flow barriers arranged in series near and on brim 20 to block unwanted discharge of liquid from liquid reservoir chamber 22 while lid 14 is in place on cup 12 as suggested in Figs. 5 and 6.

As shown in Fig. 1, cup 12 includes brim 20, a floor 28, and a side wall 40 extending from brim 20 to floor 28. Side wall 40 is formed to include a large-

diameter top portion 46 appended to brim 20, a small-diameter bottom portion 48, and a body portion 50 located between top and bottom portions 46, 48 as shown in Fig. 1. Side wall 40 also includes an annular top transitional portion 52 interconnecting top portion 46 and body portion 50 as shown, for example, in Figs. 5 and 6. Side wall 40 also includes a "scalloped" annular bottom transitional portion 54 interconnecting  
5 body portion 50 and bottom portion 48 as suggested in Fig. 1.

As shown, for example, in Fig. 5, brim 20 includes, in series, a lid retainer 56, an inner annular strip 58, an annular bridge 60, and an outer annular strip 62. Lid retainer 56 is rooted to an upper portion of top portion 46 to anchor brim 20  
10 to top portion 46. Outer annular strip 62 is oriented to lie in concentric relation to inner annular strip 58 and annular bridge 60 extends horizontally to link inner and outer annular strips 58, 62 as suggested in Fig. 5. Strips 58, 62 and bridge 60 cooperate to form a downwardly opening annular channel 64 above an exterior surface of lid retainer 56 in the illustrated embodiment. Outer annular strip 62  
15 includes an axially downwardly facing annular terminal end 63.

Brim 20 is configured to form several seal surfaces arranged to mate with companion portions of lid 14 as suggested in Figs. 5 and 6. Large-diameter top portion 46 includes radially inwardly facing first annular seal surface 41. Inner annular strip 58 includes second radially inwardly facing second annular seal surface  
20 42. Annular bridge 60 includes axially upwardly facing third annular seal surface 43. Outer annular strip 62 includes radially outwardly facing fourth annular seal surface 44.

Lid retainer 56 is a frustoconical segment in the illustrated embodiment and extends from top portion 46 to inner annular strip 58 in a radially inwardly projecting, axially outwardly extending direction as shown in Figs. 5 and 6. Lid  
25 retainer 56 is arranged to converge toward a reference point (not shown) located along reference line 57 and in spaced-apart relation to floor 28 to position lid retainer 56 therebetween to provide an undercut 59 under inner annular strip 58 as suggested in Figs. 5 and 6. Annular terminal end 63 of outer annular strip 62 is arranged to extend  
30 around frustoconical lid retainer 56 as suggested in Figs. 5 and 6.

As shown in Figs. 1 and 2, closure 16 of lid 14 includes a round hub 70 providing a straw receiver 72, five radially extending spoke ribs 74 terminating at hub

70, and an inclined plate 76 located between each pair of adjacent spoke ribs 74. In the illustrated embodiment, closure mount 18 is ring-shaped and arranged to encircle radially outermost portions of spoke ribs 74 and inclined plates 76. Each spoke rib 74 includes first and second side walls 73, 75 and a top wall 77 interconnecting side walls 73, 75 as suggested in Figs. 2 and 4. Deformation of side walls 73, 75 of one of spoke ribs 74 during mounting of lid 14 on brim 20 of cup 12 is shown in phantom in Fig. 4.

Retainer 24 in lid 14 is defined by an annular first lid-removal blocker wall located between and arranged to interconnect first and second seal rings 31, 32. First lid-removal blocker wall 24 is arranged to engage frustoconical lid retainer 56 during movement of lid 14 in an outer direction 78 (see Fig. 6) away from floor 28 of cup 12 to block unwanted removal of lid 14 from cup 12. In the illustrated embodiment, first lid-removal blocker wall 24 has a frustoconical shape. As suggested in Fig. 4, first seal ring 31 has a larger diameter than second seal ring 32. Closure mount 18 further includes an annular lid-removal flange 80 located below fourth seal ring 34 and arranged to extend downwardly in an inner direction 79 opposite to outer direction 78. Retainer 26 included in lid 14 forms a part of closure mount 18 and is formed to provide a second lid-removal blocker wall. This second lid-removal blocker wall 26 is arranged to engage terminal end 63 of brim 20 during movement of lid 14 in outer direction 78 to block unwanted removal of lid 14 from cup 12.

Lid-removal flange 80 includes, in series, first, second, third, and fourth annular segments 81, 82, 83, and 84 as shown in detail in Figs. 5 and 6. Second lid-removal blocker wall 26 has a frustoconical shape and is arranged to interconnect first annular segment 81 of lid-removal flange 80 and fourth seal ring 34 of closure mount 18. Each of the segments have frustoconical shapes of various slopes.

First annular segment 81 is arranged to surround first seal ring 31 to define an annular channel 85 therebetween. When lid 14 is mounted on brim 20 of cup 12, radially inwardly facing first annular seal surface 41 is located in annular channel 85 as shown, for example, in Fig. 6.

Referring to the illustration of closure mount 18 in Fig. 5, fourth seal ring 34 is aligned in concentric relation with second seal ring 32. The diameter of fourth seal ring 34 is greater than the diameters of first and second seal rings 31, 32. Closure mount 18 also includes an annular quarter round-shaped inner rim 86

5 interconnecting second and third seal rings 32, 33 and an annular quarter round-shaped outer rim 88 interconnecting third and fourth seal rings 33, 34 as suggested in Fig. 5. Second, third, and fourth seal rings 32, 33, 34 cooperate to define an annular chamber 89 communicating with annular channel 85 and receiving brim 20 therein when lid 14 is mounted on cup 12 as suggested in Fig. 6.

10 Closure 16 includes a peripheral portion comprising outer frustoconical wall 90 appended to first seal ring 31, inner frustoconical wall 91 appended to inclined plates 76, and middle frustoconical wall 92 arranged to interconnect outer and inner frustoconical walls 90, 91 as shown in Figs. 1, 3, and 5. These walls 90-92 cooperate to support inclined plates 76 as suggested in the drawings.

15 The slope of inclined plates 76 provided in lid 14 increases once lid 14 is mounted on cup 12. Owing, in part, to configuration of walls 90-92, a first of inclined plates 76 has a first slope (defined by first acute angle 93) with respect to a horizontal reference plane 94 before closure mount 18 is mounted on brim 20 of cup 12 as suggested in Fig. 5. That inclined plate 76 is moved to assume a steeper second  
20 slope (defined by second acute angle 95) with respect to horizontal reference plane 94 upon coupling of closure mount 18 on brim 20 as suggested in Fig. 6. As lid 14 is mounted on brim 20 of cup 12, dimension 100 between radially outwardly facing surfaces of first seal ring 31 and first annular segment 81 will increase as suggested by greater dimension 101 owing, in part, to dimension 102 between radially  
25 outwardly facing fourth annular seal surface 44 and radially outwardly facing surface of top portion 46 since dimension 102 is greater than dimension 100.

Lid 114 shown, for example, in Figs. 7-12, incorporated many of the features associated with lid 14 shown, for example, in Figs. 1-6. Retainers 124, 126 included in lid 114 are arranged to engage portions of cup 112 to block unwanted  
30 removal of lid 114 from cup 112 as suggested in Fig. 12. Four seal rings 131, 132, 133, and 134 are provided on lid 114 to engage companion annular seal surfaces 141, 142, 143, and 144 on cup 112 to establish four liquid flow barriers arranged in series

near and on brim 120 of cup 112 to block unwanted discharge of liquid from a liquid reservoir chamber 122 in cup 112 while lid 114 is in place on cup 112 as suggested in Fig. 12.

As shown, for example, in Fig. 12, cup 112 includes brim 120 and a side wall 140 extending downwardly from brim 120. Side wall 140 is formed to include a large-diameter top portion 146 appended to brim 120, a body portion 150 located under top portion 146, and an annular transitional portion 152 interconnecting top portion 146 and body portion 150. Brim 120 also includes a lid retainer 156 as suggested in Fig. 12.

Closure 116 of lid 114 includes a round hub 170 providing a straw receiver 172 and five radially extending spoke ribs 174 terminating at hub 170. Closure 116 also includes an inclined plate 176 located between each pair of adjacent spoke ribs 174. Lid 114 also includes a lid-removal flange 180 as suggested in Figs. 8, 9, and 12.